

IMPROVING PRODUCT DATA

A ROADMAP TO FUTURE PARTS PROCUREMENT

MARCH 2010



Improving Product Data

DLA procures parts and provides them to its military service customers, our nation's warfighters. To provision its customers, DLA often must provide product data to industry so that parts can be built to military requirements and standards.

Much of industry, including many DoD suppliers, has moved to computer-driven design, product sourcing, and manufacturing using 3-dimensional (3D) product data, which is a combination of technical data in 3D models and associated data (such as manufacturing processes, material, etc.).

DLA still procures many weapon system parts using legacy 2-dimensional (2D) technical data formats,¹ which are often split into single-sheet (raster) pictures. These older formats require suppliers to build product models before the parts can be manufactured, adding time and cost to DLA's procurement process. Related information is often missing or incorporated only by reference. The current process of providing technical data to suppliers, planning to build, and building parts using existing technical data is often cumbersome and overly costly for DLA and the manufacturer.

DLA gets this data from the military services' engineering support activities (ESAs). Product or technical data originates with the original equipment manufacturer (OEM), and the right to use the data is usually acquired by the program management office (PMO) very early in the acquisition lifecycle. By the time a system is in the sustainment phase of its lifecycle, DoD should have rights to the product data (whether the data resides on a DoD computer or the OEM's computer system) to use during parts procurement.

VISION

Over the next 8–10 years, DLA intends to maximize its use of modern product data and, thereby, increase efficiency, increase competition for parts, and minimize delays in its Class IX parts procurement. DLA developed a simple vision for the future state of product data. That vision encompasses both legacy data and newer data delivered through acquisition programs.

Vision: *DLA will have access to a continuous flow of authoritative product data sufficient for economical reprocurement.*

The 8–10-year horizon allows the desired end-state to be stated without the constraints of current policies, operations, technology, and data.

¹ In this report, the term “technical data (TD)” refers to legacy data, and product data (PD) refers to modern 3D data, which is delivered, to a limited extent, now but will be more widely available in the future.

GOALS

To achieve its vision, DLA identified six major goals for future parts procurement:

- ◆ Goal 1. DLA specialists can easily identify and log into the authoritative source for product data (PD) for a specific part.
- ◆ Goal 2. The authoritative PD for all parts is complete, accurate, and up to date.
- ◆ Goal 3. DoD's PD enables efficient, economical reprocurement.
- ◆ Goal 4. DoD obtains full product data and data rights for all new non-commercial parts entering the logistics system.
- ◆ Goal 5. DLA develops and executes a strategy for modernizing legacy PD.
- ◆ Goal 6. The DLA workforce can use modern PD effectively.

A discussion of each goal follows, with mention of the current state, objectives to support the goal, and recommended actions to achieve those objectives. In a later section, all the recommended actions are consolidated into a roadmap for DLA to follow.

Goal 1—Access

DLA SPECIALISTS CAN EASILY IDENTIFY AND LOG INTO THE AUTHORITATIVE SOURCE FOR PRODUCT DATA FOR A SPECIFIC PART

This initial goal deals with DLA's ability to find and use the correct technical data.

GOAL 1: OBJECTIVE 1—The authoritative source for needed product data is easily identifiable. The PD is stored in a known set of product data management (PDM) systems, and what is in those PDM systems is clearly identified.

In today's environment, the military services' engineering support activities, or ESAs, are the authoritative sources for data on parts. It is sometimes difficult to ascertain which technical data package (TDP) is the correct version for a particular use. For example, the newest TDP may not be the best to use for a given part; or the OEM, ESA, and DLA may have different versions. Currently, there are more than 30 repositories for TD and PD within the military services.

GOAL 1: OBJECTIVE 2—Metadata about PD in any PDM system is complete, accurate, and up to date. Responsibility and authority for data quality and completeness are clear and accepted.

Today, all the necessary information to build a part is not necessarily in the TDP. Some data, such as configuration or process, may not be included or may be incomplete.

GOAL 1: OBJECTIVE 3—The DLA staff has unrestricted access to all required PDM systems.

At present, DLA staff have online access to only some ESA repositories. Interaction with ESAs regarding TDPs involves Form 339, e-mail, and telephone calls, rather than direct access in many cases.

ACTIONS TO BE TAKEN

Achievement of many of these goals will require that DLA work in partnership with other DoD organizations; for example:

- ◆ DLA will work with the military services to remain abreast of their enterprise resource planning (ERP) and PDM or Product Lifecycle Management (PLM) implementations and ensure DLA has continuous access to complete, authoritative product data.
 - Air Force Team Center/ECSS² and an ERP (to be selected)
 - Army's implementation of SAP/PLM+³
 - Navy's consolidation of JEDMICS⁴ sites—the Naval Ships Engineering Drawings Repository (NSEDW) for NAVSEA and a San Diego JEDMICS site for NAVAIR.
- ◆ DLA will collaborate with the larger DoD community (the services and the Office of the Secretary of Defense, or OSD) on standard metadata for PD files as the military services upgrade their enterprise PLM systems. The Air Force already has well-documented metadata for TDP acceptance; the Army PLM+ implementation should have its metadata for TD defined soon. DLA must work with the military services to ensure the metadata in their PLM systems supports all objectives for Goal 1.
- ◆ DLA will continue to write performance based agreements with the military services for direct access to PD repositories, and DLA will work toward establishing accounts that receive notification of changes to PD and

² Expeditionary Combat Support System, the Air Force's new logistics system.

³ PLM+ is the Army's implementation of SAP's Product Lifecycle Management and NetWeaver products.

⁴ Joint Engineering Data Management Information and Control System is the legacy DoD-wide repository for TD drawings.

related metadata (either “pushed” from the repository to product data management initiative [PDMI], or pulled using another mechanism).

Goal 2—Content

THE AUTHORITATIVE PD FOR ALL PARTS IS COMPLETE, ACCURATE,
AND UP TO DATE

GOAL 2: OBJECTIVE 1—All parts of the PD are easily located and accessed, regardless of the location of the authoritative source.

GOAL 2: OBJECTIVE 2—The PD for a part includes all information necessary for the procurement and manufacture of that part. This may include, but is not limited to, part geometry, dimensioning, and tolerancing information as well as numeric control machine coding information.

GOAL 2: OBJECTIVE 3—PD includes any text, process, material, or other data needed by a manufacturer.

All three of these objectives support the attainment of Goal 2. Current legacy TDPs are mostly 2D drawings, and may not contain all the information needed to procure or accurately manufacture a part. For example, 2D drawings may not have full information on geometry, they may have dimensions and tolerances but no information on material and finish, or information captured when a physical 2D drawing (paper or Mylar) was scanned into electronic form may be illegible and unusable.

Once DLA locates the authoritative source for a part’s PD, all pieces of the TDP should be at that source. Sometimes a complete, up-to-date package includes the latest revisions of a drawing, but it may be marked proprietary. If so, an older version with government data rights must be located. Ultimately, the PD or TDP must be as complete, accurate, and up to date as possible.

ACTIONS TO BE TAKEN

- ◆ DLA and the military services will share information on their respective PDM/PLM implementations, such as lessons learned, common metadata, etc.
- ◆ DLA and the military services will identify legacy TDPs that need to improve. DLA and the military services will also determine which TDPs merit an investment to make them complete and accurate.

Goal 3—Enable Procurement

DoD's PD ENABLES EFFICIENT, ECONOMICAL REPROCUREMENT

GOAL 3: OBJECTIVE 1—The preferred format of PD is a 3D model approved for procurement use.

Many of DLA's suppliers, even small businesses, are using computer-aided design and manufacturing (CAD and CAM) applications, and building a 3D model is now an integral part of manufacturing. Providing a 3D model in a modern PD format allows businesses to more quickly and accurately bid for a DLA contract and manufacture parts. When DLA offers a 2D drawing as part of a bidset, the result is a higher cost to the government and a smaller pool of bidders.

GOAL 3: OBJECTIVE 2—All PD is available in a neutral format as well as other specific formats.

GOAL 3: OBJECTIVE 3—To attract more bidders, and to save them planning and pre-manufacture time, DLA routinely provides bidders with PD that is manufacture-ready (e.g., PD with information for numerical control machining).

To reach the largest number of bidders, DLA should provide PD in a neutral format, one that allows bidders to import the file into their CAD/CAM software. Because native formats capture *more* information than is captured by neutral formats, there will always be a need to capture native formats (Dassault Systemes' CATIA, Parametric Technology Corporation's Pro/Engineer, Autodesk's AutoCAD, etc.). Also, acquisition programs and ESAs may use different CAD/CAM and PDM/PLM systems, so the number of file formats DLA must support could become unmanageable—especially when you consider the number of versions of each CAD/CAM format that may occur across a DoD acquisition program's lifecycle.

ACTIONS TO BE TAKEN

DLA and the larger DoD community will explore the number of formats for modern 3D data deliveries over the next 5–7 years and work with their military service partners to limit the number of formats. The intent is to allow DLA to plan and change, in an orderly fashion, its tools, training, and business processes to handle modern 3D TD.

The following are possible approaches to achieve all Goal 3 objectives:

- ◆ DLA and the services' ESAs could agree on a set list of formats to be supported (native, neutral, and viewable), and a common plan for responding to changes in software versions for all three formats.
- ◆ DLA and the services' ESAs could agree on a robust neutral format (for example, using some of the standard for the exchange of product model

data application protocols [STEP APs] with conformance classes) for DLA's use. DLA must then support one format, across the board, which will change more slowly than any native format. Both DLA and the ESAs may have a data format conversion requirement as a consequence, but an international standard format has the best probability of being supported with numerous conversion tools.

- ◆ DLA should work with the larger DoD community on PD format issues and a plan for handling those formats over the very long PD lifecycle. For example, the DoD Engineering Drawing Modeling Working Group (DEDMWG) is working on common practices and formats for 3D models for engineering weapon systems; DLA is a member of that group.

Goal 4—Data Rights for New Parts

DoD OBTAINS FULL PRODUCT DATA AND DATA RIGHTS FOR ALL NEW NON-COMMERCIAL PARTS ENTERING THE LOGISTICS SYSTEM

GOAL 4: OBJECTIVE 1—DLA influences DoD policies, procedures, and practices to ensure complete PD is acquired for new parts.

GOAL 4: OBJECTIVE 2—DLA reviews all new parts presented for cataloging to ensure PD is complete and usable for procurement.

In general, the PD management function in DoD needs revitalization. There are pockets of excellence—the Air Force, for example, has an enterprise approach to PD acquisition, validation, and acceptance—but most DoD data managers are concerned that PD is not being sufficiently or effectively acquired across DoD. DLA can work with the larger DoD PD community to emphasize the critical need for robust PD management.

ACTIONS TO BE TAKEN

- ◆ DLA will work with OSD's Software and Systems Engineering (SSE) office to improve the data management strategies required by DoD Instruction 5000.02, *Operation of the Defense Acquisition System*.

SSE's program for improving systems engineering plans is sending specialists to acquisition programs to review their system engineering plans and improve those plans. A similar approach for the data management strategies could be useful to program managers, and DLA product data specialists might be able to augment those teams.

- ◆ DLA will continue to urge OSD and the military services to procure PD in the acquisition phase of the program lifecycle.

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- ◆ DLA will work with the Defense Logistics Information Service (DLIS) to improve PD acquisition and management at the start of the operations and sustainment phase of a program's lifecycle, and as part of the provisioning process.
 - ◆ DLA can collaborate with the larger DoD community to address the workforce issues in PD management. Currently, this issue is being addressed by the DEDMWG and the DAU's Life Cycle Logistics (LCL) functional integrated process team (FIPT), which develops both the curriculum and workforce requirements for a particular functional area.

The LCL FIPT is an active group, and would be the appropriate venue to raise issues of sufficient workforce and training in PD management within DoD. It meets bi-monthly, and will address issues from all phases of a program's lifecycle. According to an October 2009 briefing, the LCL FIPT plans to deliver a course in technical data (LOG215) via distance learning in FY2012.

- ◆ DLA will make its issues in PD more visible to a larger, more diverse DoD community. The audience for DLA's message includes program managers, contracting officers, and system engineers. The following are possible vehicles for that message:
 - An article in the *Defense AT&L Magazine* (or other channels to reach acquisition programs) on the benefits of robust TD management early in the program, and strategies to correct TD management deficiencies later in a program's life cycle.
 - A series on acquisition of technical data topics.
 - The mechanisms for separate pricing of PD delivery
 - Options for specifying PD deliveries later in the acquisition under various contract types (firm fixed price, time and materials, etc.)
 - Adjudication of OEM assertions of proprietary or other limited rights data
 - Validating delivery of PD in various forms (3D CAD, 3D models, etc.).

Goal 5—Legacy Data

DLA DEVELOPS AND EXECUTES A STRATEGY FOR MODERNIZING LEGACY PD

GOAL 5: OBJECTIVE 1—Two-dimensional TD is provided in a single .pdf file (rather than multiple-file raster scans).

GOAL 5: OBJECTIVE 2—Business rules determine when to update legacy data to full 3D PD. Such rules may be applied to update some parts' designs to use modern designs, materials, and manufacturing processes.

GOAL 5: OBJECTIVE 3—Parts and data are prioritized and then updated over the next 7–10 years.

GOAL 5: OBJECTIVE 4—Legacy data that is available in a 3D format—but was delivered to the government as raster data to comply with contract requirements—is identified.

DLA cannot wait for 3D PD from new acquisitions to begin upgrading the data it uses in bid sets. In the near term (3–5 years), improvements can be made in the 2D TD that DLA already has in its repositories. DLA needs to work with the military services to determine what data was delivered to the government in a raster format, even though the contractor may have had the PD in a 3D format.

ACTIONS TO BE TAKEN

The gap in this area is the 2D format of legacy TD, and the lack of any data beyond that marked on the drawing. The military services should have the lead in this area, but DLA may decide to convert some TDPs as well. In the case of certain parts, it may be worthwhile to convert the data from two dimensions to a modern 3D format.

- ◆ The military services and DLA will develop business rules that will guide their staffs in determining what legacy TDPs to convert. The following factors must be considered:
 - Benefits to be gained from conversion
 - Updating availability of parts by introducing new sources or new technology.
 - Price reductions because a duplication in planning is avoided.
 - Improved quality through consistent requirements.

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- Approach to conversion
 - Service houses perform this type of data conversion; using such a service is one approach to conversion.
 - Because DLA's suppliers must produce a 3D model to manufacture the part, DLA may be able to buy the rights to those models.
 - Cost of conversion
 - Service house charges plus cost of ESA validation of the product data for its use in procurement.
 - Cost of data rights from DLA suppliers plus cost of ESA validation of the product data for its use in procurement.
 - Complexity of the part.
 - Cost and benefit assessment to determine which TDPs to convert based on economic factors and in light of available resources.
 - ◆ DLA will develop a validation process with the ESAs for 3D PD from other than normal sources (reverse engineering, or DLA suppliers, for example). This may require first article testing, or another approach.

Depending on these factors and the anticipated number and volume of future buys, one approach may be more economical for a particular part.

Goal 6—Workforce

THE DLA WORKFORCE CAN USE MODERN PD EFFECTIVELY

GOAL 6: OBJECTIVE 1—DLA staff (product data specialists and product specialists, for example) are trained in the use of modern PD.

GOAL 6: OBJECTIVE 2—DLA provides its staff with appropriate tools, where they are needed, to use modern PD (such as software and updated business processes).

Most of the DoD acquisition workforce has little experience in the management of 3D PD, and DLA is no exception. In addition, the tools needed to read and use 3D PD are not in use within DLA. DoD's workforce will need training and tools to effectively use modern PD.

ACTIONS TO BE TAKEN

- ◆ Once DLA and the military services' ESAs agree to the list of formats for 3D PD, DLA will develop training in the use of that data in procurement.
- ◆ DLA will develop the business rules for the use of 3D PD, addressing such things as format for receipt or download from ESA.

CONSOLIDATED LIST OF ACTIONS

Policy and Guidance

DLA must work with the larger DoD community to ensure key guidance is updated and followed.

- ◆ The DoD authority for technical data management policy rests with OSD, Design Development Research and Engineering (DDR&E), SSE. SSE has worked with the DoD Engineering Drawing and Modeling Working Group (DEDMWG)⁵ and industry organizations (the National Defense Industrial Association, for example) on standards and guidance issues. [*Long term*—DLA and SSE]
- ◆ MIL-STD 31000, *Technical Data Packages*, was updated by the DEDMWG. It is simplest to use DEDMWG to draft the updates needed to encompass modern 3D PD formats. [*Near term*—DLA and DEDMWG]
- ◆ *The Procedures for the Acquisition and Management of Technical Data* (DoD 5010.12-M) is the most detailed guidance DoD has issued on TD management. This manual must be updated. SSE and other interested organizations (OSD Logistics and Materiel Readiness or the DEDMWG, for example) may wish to engage in the update. Once updated, DoD 5010.12-M could be a key mechanism for ensuring policy is followed consistently across DoD. [*Long term*—DLA and SSE and other interested organizations]

Operations

The TD management function within DoD needs to be revitalized. DLA must work with the larger DoD TD community to emphasize the critical need for robust TD management.

- ◆ DLA will support and assist DLIS in its provisioning initiative. [*Near term*—DLA and DLIS]
- ◆ DLA's TD issues and efforts require greater visibility within DoD. DLA will provide articles for periodicals, content for DoD websites, and information for the data management community of practice (DM COP) maintained by the Defense Acquisition University (DAU). DLA must identify the intended audience and the appropriate channels to reach that audience, and then work with content providers. [*Mid term*—DLA]

⁵ DEDMWG charter is currently in coordination; DLA is a member of the working group.

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- ◆ DLA will work with SSE to improve the data management strategies required of acquisition programs by DODI 5000.02. DLA will also assist in the review of the data management strategies required as part of an acquisition strategy. [*Long term*—DLA and SSE]
 - ◆ DLA will collaborate with LCL FIPT, assist in developing requirements for the TD workforce, and accelerate curriculum and course development. [*Long term*—DLA and OSD(L&MR)⁶]
 - ◆ DLA will work with the greater DoD community (the military services and OSD) on standard metadata for TDPs. It may be best to start with an assessment of the Air Force's metadata guidance. [*Long term*—DLA and SSE]

Technology and Technical Data

DLA must address both legacy data and the data from current acquisition programs; they will require different approaches.

LEGACY DATA

- ◆ DLA will develop business rules for the selection of legacy TDPs for conversion to 3D PD. It will consider the various approaches to conversion, their relative costs, and, in partnership with the ESAs, a way to validate the output of a given conversion approach. [*Near term*—DLA and the military services' ESAs]
- ◆ DLA will engage the military services on their PDM/PLM implementations and address data cleanup as part of the larger implementation. [*Long term* (starting immediately)—DLA and the military services]
- ◆ DLA will determine which legacy TDPs need to be improved or converted to modern 3D PD; DLA will then work with the ESAs to make those TDPs complete and accurate. [*Long term* (starting immediately)—DLA and the military services]

ACTIVE ACQUISITION PROGRAMS

- ◆ DLA will determine, with the services, the formats for modern 3D PD deliveries from OEMs and suppliers for the next 5–7 years. It will also ensure that native, neutral, and viewable formats are defined, and plan how it will respond to changes in software versions for all three formats. DLA will determine how STEP formats will be used (for example, which Application Protocols) and determine where conformance classes are needed to ensure reusability of exchanged 3D PD. [*Long term*—DLA and the military services]

⁶ LCL FIPT reports to OSD(L&MR).

- ◆ Once a set list of formats for 3D PD is agreed to, DLA will develop training in the use of that data during procurement. [*Long term*—DLA and the military services]
- ◆ DLA will develop the business rules for the use of 3D PD within DLA, addressing such things as format for receipt or download from ESA. [*Long term*—DLA and the military services]
- ◆ DLA will work with the services' ESAs on volume licensing terms for software to support the native, neutral, and viewable formats. [*Long term*—DLA and the military services]
- ◆ DLA will work with the greater DoD community on 3D PD format issues and develop a plan for handling those formats over the very long PD life-cycle. [*Long term*—DLA and the military services]

RECOMMENDED ROADMAP

Actions and Timing

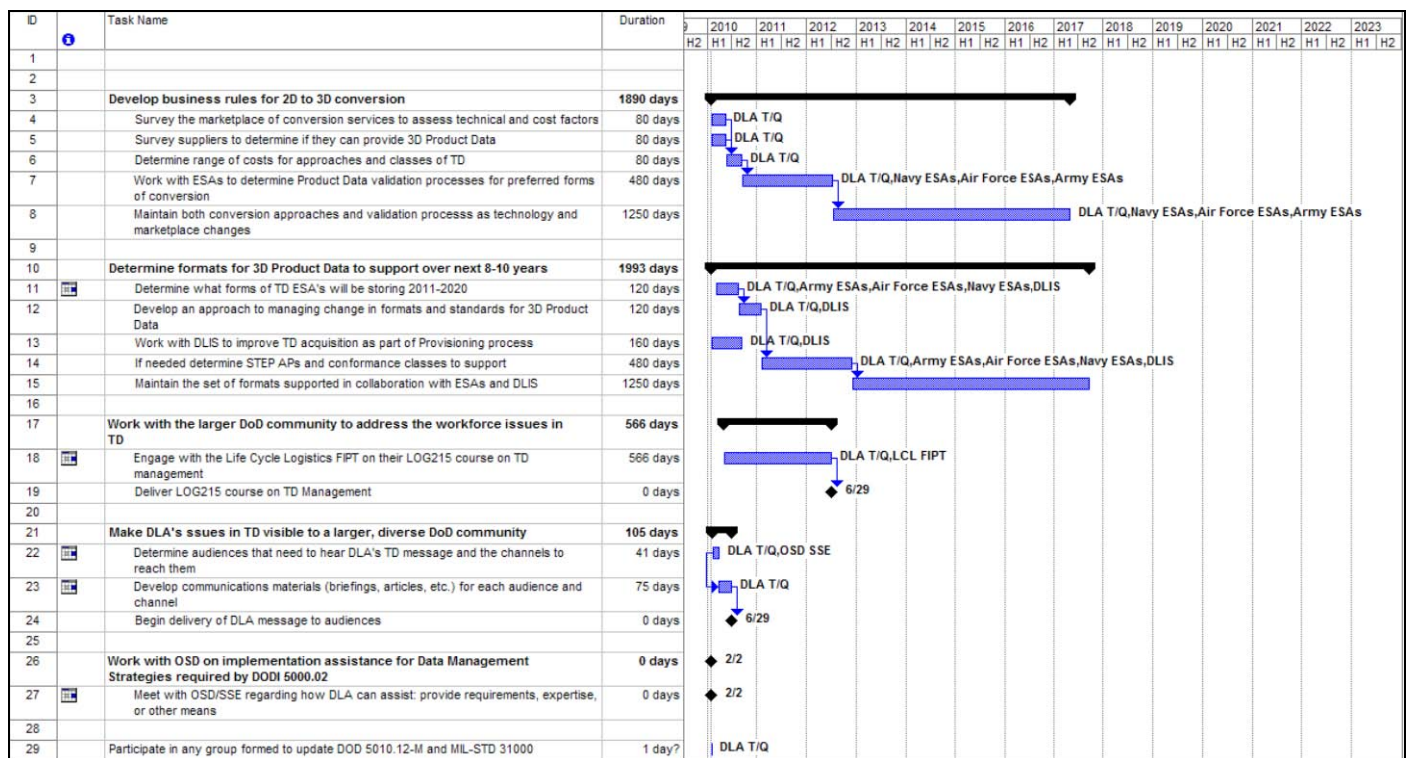
| Area | Near-term actions | Mid-term actions | Long-term actions |
|-------------------------------|---|--|---|
| Policy and guidance | Update MIL-STD 31000 | Update DoD 5010.12-M | Develop data management policy with SSE |
| Operations | Support DLIS Provisioning Develop articles for <i>AT&L Magazine</i> Work with DoD community on standard metadata for TDPs | Identify communications channels/contribute content Coordinate with the military services regarding their PDM/PLM implementations | Develop data management strategies with SSE Coordinate workforce issues with OSD(L&MR) |
| Technology and technical data | Iron out 2D-to-3D conversion issues with ESAs Identify which legacy TDPs need improvement | | Enter into an agreement with ESAs on 3D PD formats |

Roles and Responsibilities

| Action | DLA T/Q | DLIS | ESAs | OSD |
|---|---------|------|------|------------------|
| Develop business rules for 2D-to 3D-conversion | P | | S | |
| Determine formats to support 3D PD over the next 8-10 years | P | S | S | |
| Work with the larger DoD community to address the TD-related workforce issues | S | | | P (LCL FIPT) |
| Make DLA TD issues visible to a larger, more diverse DoD community | P | | | S (SSE, L&MR) |
| Develop implementation assistance for data management strategies required by DODI 5000.02 | S | | | P |
| Participate in update to DOD 5010.12-M and Mil-Std 31000 | S | | | P |

Note: P = primary role; S = support role; T/Q = technical and quality.

Timeline



CONCLUSION

DLA has developed a vision for technical data that ensures DLA will have access to technical data that is complete, accurate, and enables remanufacturing. This means any TDP delivered to DoD by an equipment manufacturer will not only have the data necessary to fully describe the part and the information needed to build the part, but the government will retain the rights to use that data for procurement.

The TDP must include all information needed to build the part—manufacturing process, geometry, dimensions, tolerances, finish, form, and fit—and in a modern form. Because most DoD parts are designed using CAD and CAM tools, the TDPs will include the 3D models produced by these tools.

To ensure a complete TDP will require the following:

- ◆ DoD program management offices (PMOs) must acquire data (data or access and rights) according to a robust data management strategy, and the data delivery schedule included in the contract with the prime contractor or OEM.
- ◆ The program's data manager must review the TDP for quality and accept these data deliveries.
- ◆ Program data managers must be trained in data delivery and acceptance, and have the needed tools (software, hardware, and subject matter experts) to perform the quality review and validation of the TDPs, including the 3D models.
- ◆ The TDP must include both the metadata for the files being delivered and the files that form the technical data delivery.
- ◆ The ESAs must develop rules and mechanisms for establishing an authoritative source for product data and configuration management.

DLA cannot take many independent actions to ensure it uses the optimal TD for procurement; most actions that enable the optimal use of TD require collaboration with the ESAs, the military services' program managers, or OSD offices. Even conversion of TD that DLA presently has on file may require collaboration with the ESAs for use in procurement. The ESAs must also be able to inform DLA of a TDP that is certified as the authoritative set of data for procurement. A benefit—and possible pitfall—of 3D data is the ease in which it can be changed by anyone with the right set of CAD tools.

Given the military services are pursuing improvements in their TD repositories, and the DEDMWG is being chartered, now is the time to pursue these improvements.

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| REPORT DOCUMENTATION PAGE | | | | <i>Form Approved</i> OMB No. 0704-0188 | |
| Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS. | | | | | |
| 1. REPORT DATE (MM-YYYY) 03 - 2010 | | 2. REPORT TYPE Final | | 3. DATES COVERED (From - To) 12/15/08 - 03/31/10 | |
| 4. TITLE AND SUBTITLE Improving Product Data: A Roadmap to Future Parts Procurement | | | | 5a. CONTRACT NUMBER SPO103-04-D-0008 | |
| | | | | 5b. GRANT NUMBER | |
| | | | | 5c. PROGRAM ELEMENT NUMBER | |
| 6. AUTHOR(S) Denise Duncan Virginia Stouffer Bruce Kaplan | | | | 5d. PROJECT NUMBER | |
| | | | | 5e. TASK NUMBER DL904.70 | |
| | | | | 5f. WORK UNIT NUMBER | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) LMI 2000 Corporate Ridge McLean, VA 22102-7805 | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER LMI-DL904C1 | |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Defense Logistics Agency, Defense Supply Center Richmond Mr. Clifford Wolfe DSCR-VE 8000 Jefferson Davis Highway Richmond, VA 23297-5611 | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) | |
| | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | |
| 12. DISTRIBUTION / AVAILABILITY STATEMENT A: Approved for public release: Distribute to DTIC and defense libraries, NTIS, or other appropriate government report databases. | | | | | |
| 13. SUPPLEMENTARY NOTES | | | | | |
| 14. ABSTRACT The Defense Logistics Agency buys parts for a wide variety of DoD systems. Many of these parts must be manufactured to order, and for those procurements, clear and complete technical data (engineering drawings, notations on materials, manufacturing processes, etc.) is needed to receive a part that performs as needed. DLA must rely on the military services' engineering support activities for current, complete, and correct technical data packages. Current manufacturing techniques include the use of 3-dimensional (3D) models to provide the technical data, both for human visualization and numerically controlled manufacturing machines. DLA bidders are prepared to use these modern data forms, but often the technical data packages consist of 2-dimensional drawings, and may lack needed information other than what is on the drawing, decreasing the pool of bidders. This report lays out a number of areas in which DLA can work with the larger DoD community to improve the product data being acquired by the military services and to prepare to use modern product data in the formats they will supply in the future. | | | | | |
| 15. SUBJECT TERMS Technical data, technical data package, TDP, Product Data, Product Data Management, PDM, model-based engineering, 3D models, data management, engineering data management. | | | | | |
| 16. SECURITY CLASSIFICATION OF: Unclassified | | | 17. LIMITATION OF ABSTRACT Unclassified Unlimited | 18. NUMBER OF PAGES 16 | 19a. NAME OF RESPONSIBLE PERSON Nancy E. Handy |
| a. REPORT | b. ABSTRACT | c. THIS PAGE | | | 19b. TELEPHONE NUMBER (include area code) 703-917-7249 |

